Economics of Overexploitation Revisited

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Economics of Overexploitation (1)

- In a 'classic' paper some 25 years ago Colin Clark observed that biological overexploitation (and even extinction) can arise from:

(1) Open access, or

(2) Profit maximisation for slow growing and economically viable populations ***even with well-defined property rights***.

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Economics of Overexploitation (2)

- Clark's second result is a theoretical possibility, but depends on the 'stock effect', i.e.,

  - sensitivity of costs and revenues to biomass and harvest

  - marginal growth in the biomass
- The larger the stock effect in terms of harvesting costs (higher stock results in lower costs), the larger will be biomass that will maximise profits.

B_{MEY} and World Fisheries

- FAO observes that about 25% of fish stocks are overfished in the sense that current biomass is less than biomass that maximises MSY (B_{MSY}).
- We show that if compared to biomass that maximises discounted net economic returns from harvesting (B_{MEY}) then many more fisheries would be considered overexploited, i.e., $B_{MEY} > B_{MSY}$

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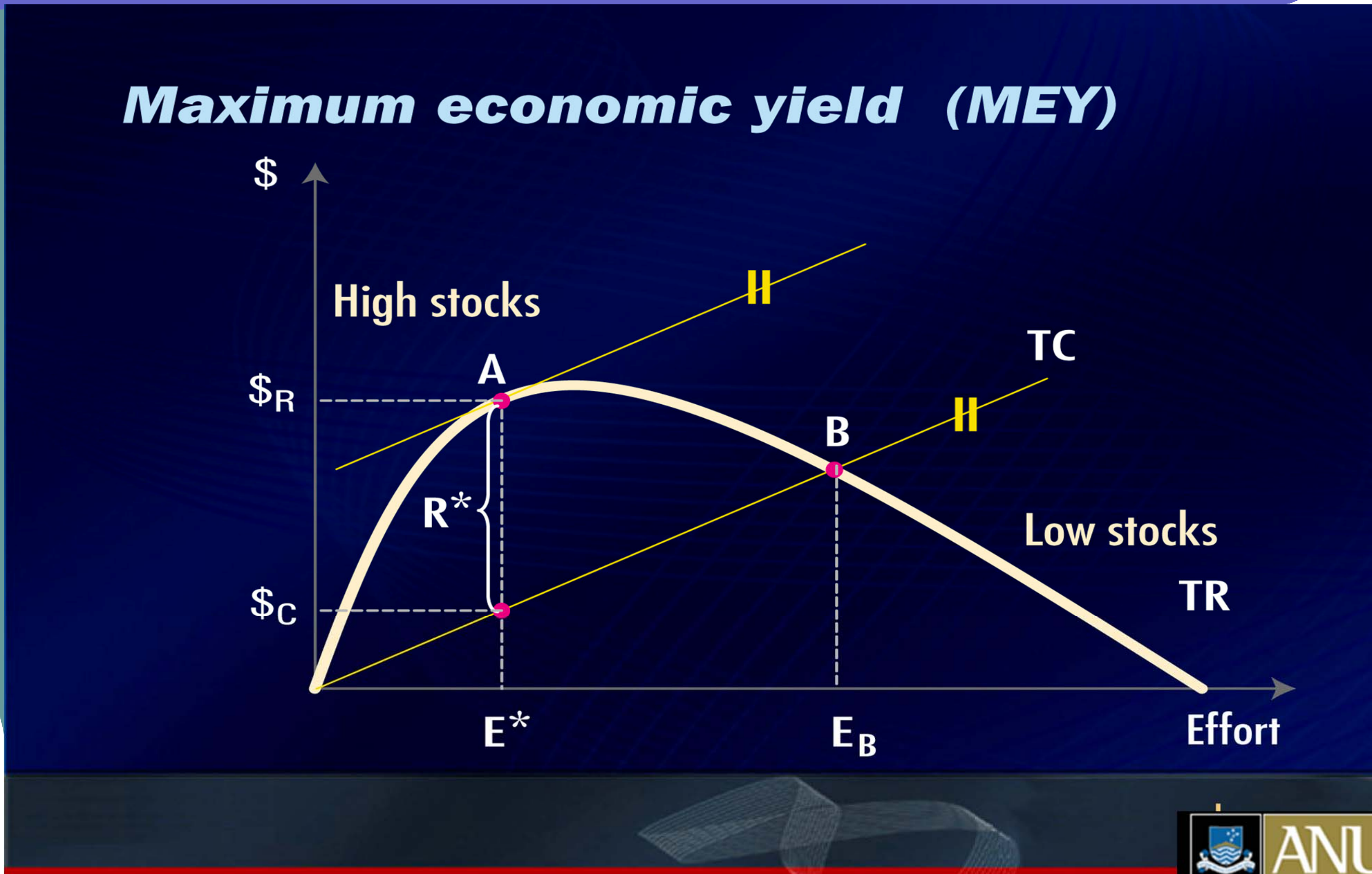
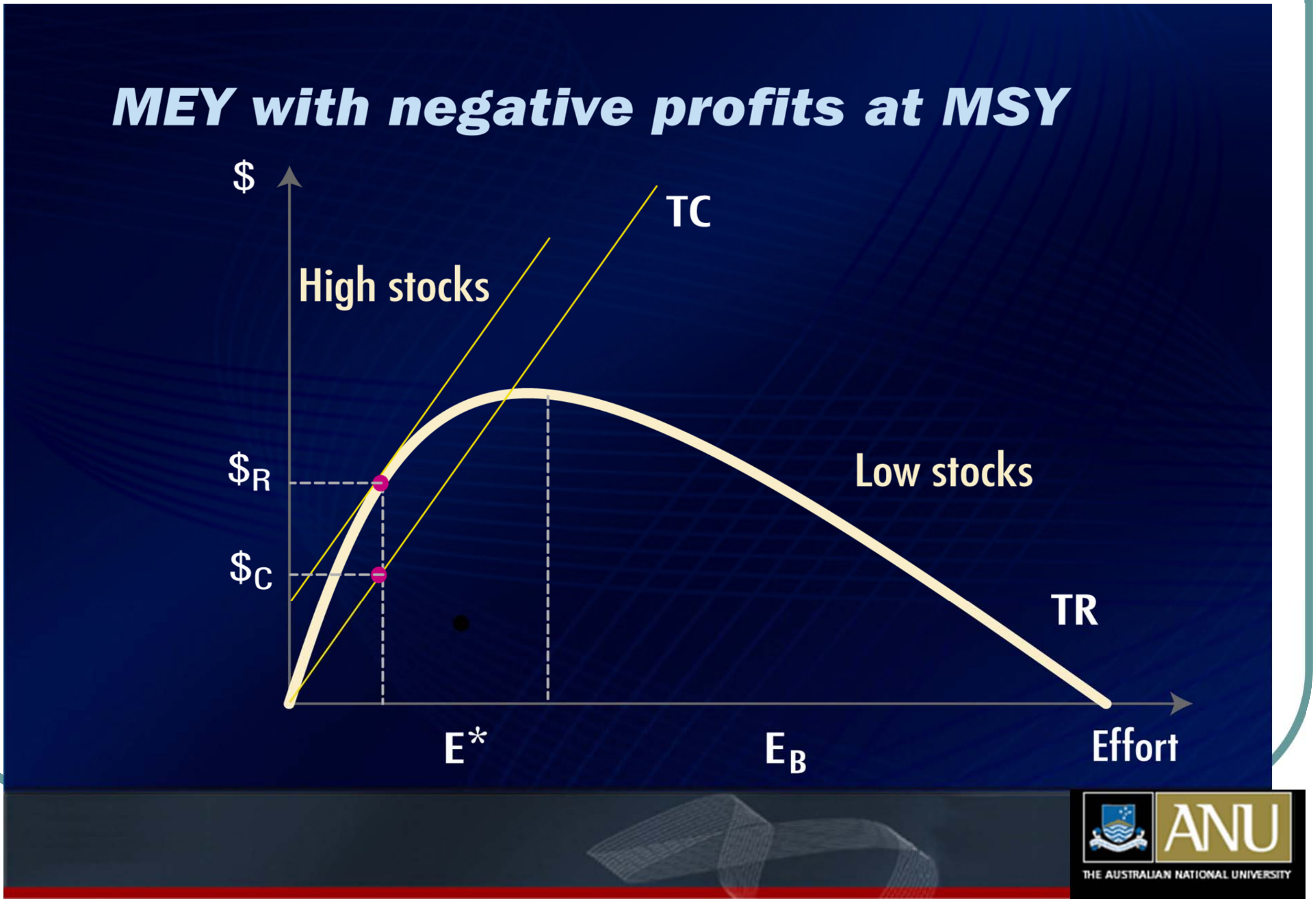
Illustration of Static MEY



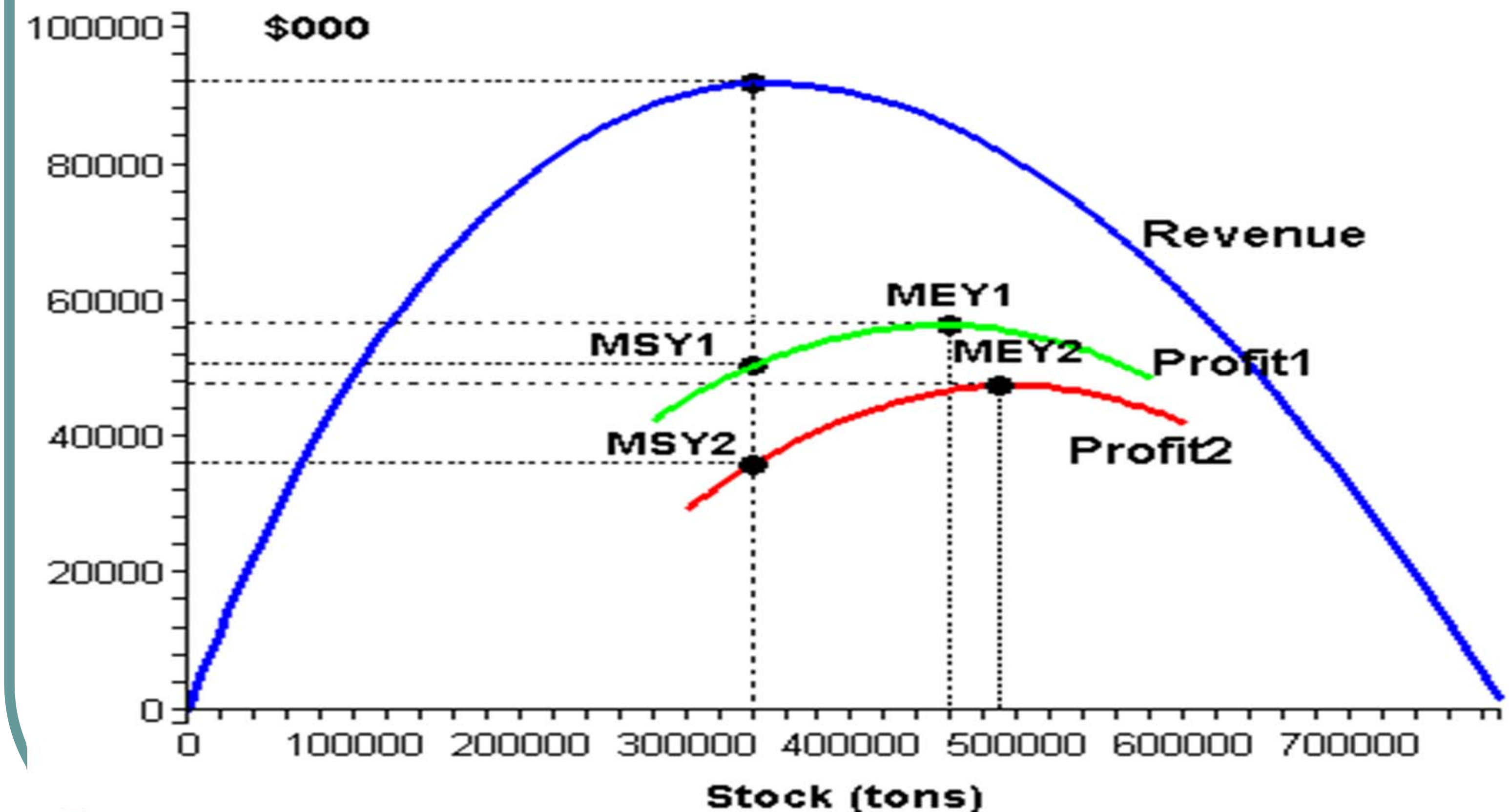
Static MEY versus MSY



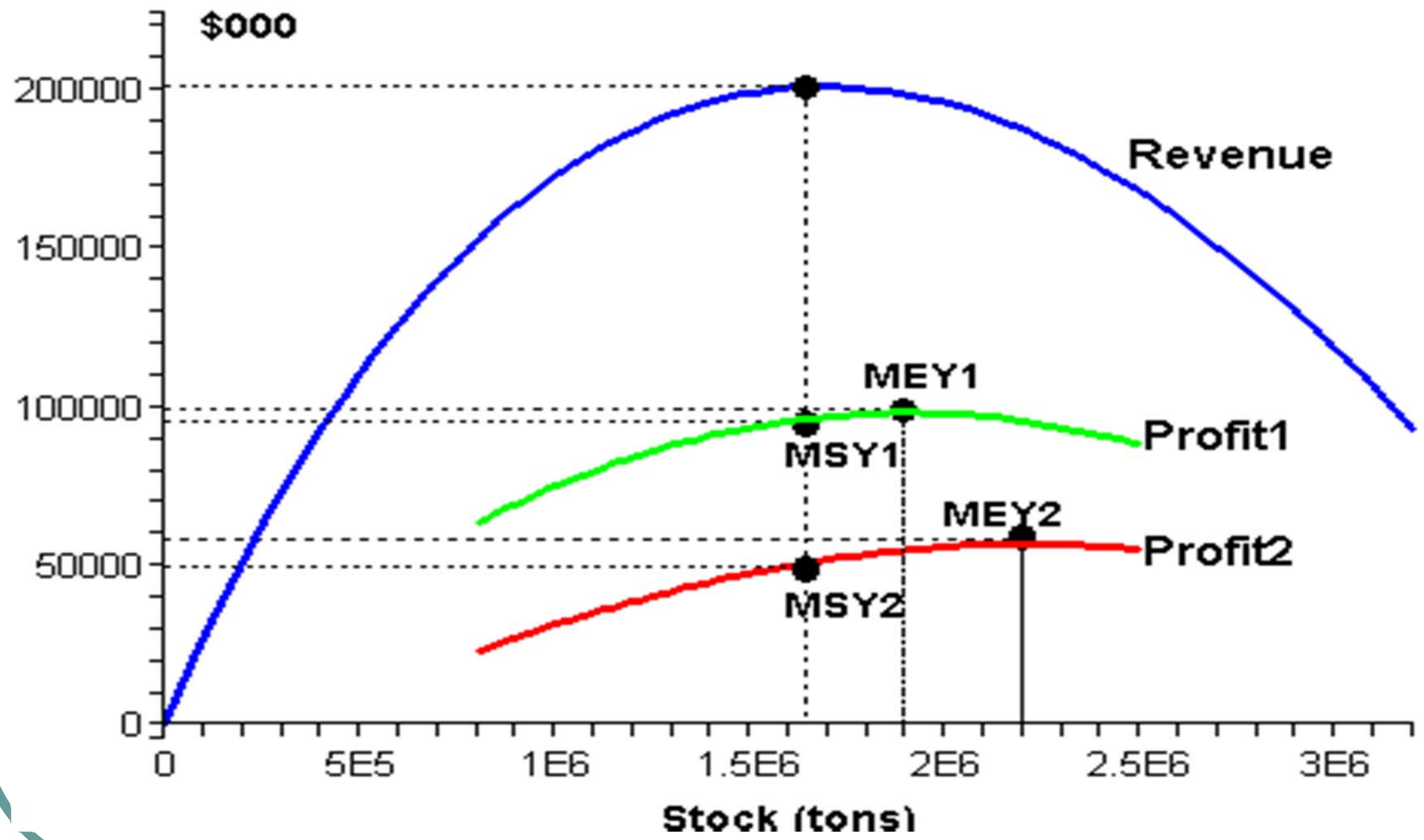
Calculating Dynamic B_{MEY}

- Previous calculations of B_{MEY} have failed to account for the ‘stock effect’ and assumed harvesting costs are independent, or are proportional to, the biomass.
- Many bio-economic studies also failed to calculate optimal transition paths to B_{MEY}.
- Using perturbation methods not previously applied in fisheries, we allow revenue to be non-linear function of harvest and costs to be non-linear function of biomass.

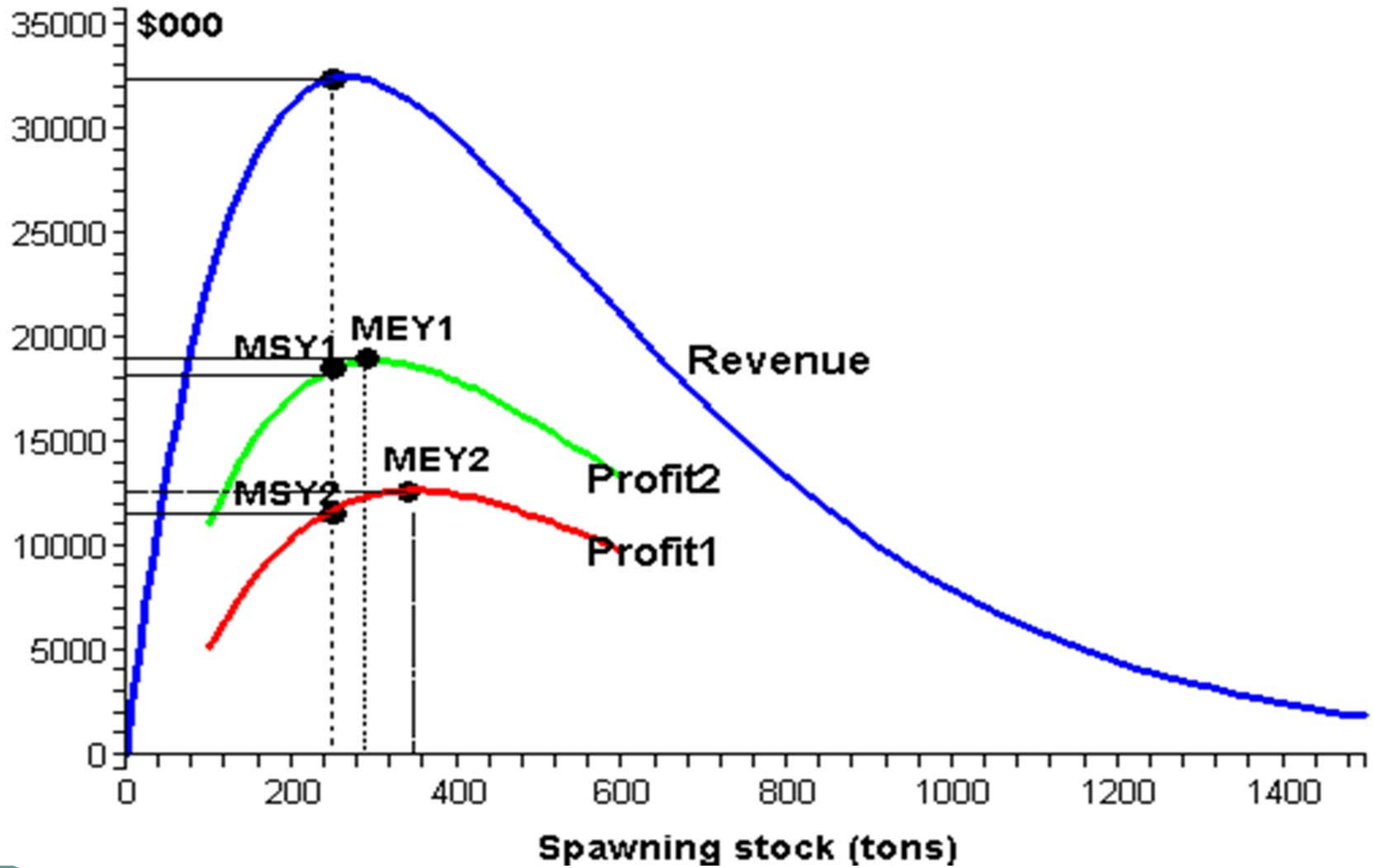
Dynamic B_{MEY}: WCP bigeye tuna



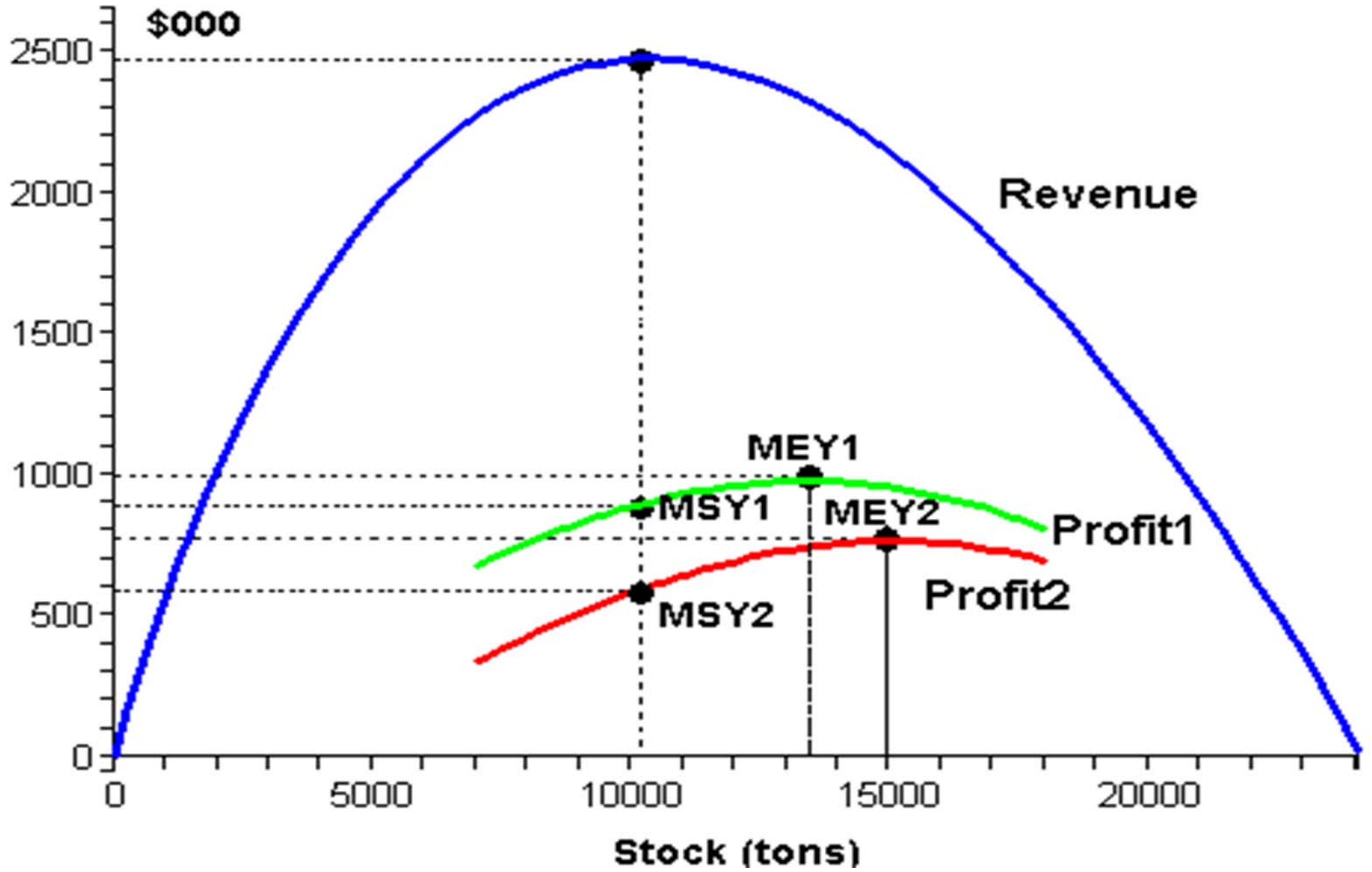
Dynamic B_{MEY}: WCP yellowfin tuna



Dynamic B_{MEY}: Australia's northern prawn fishery



Dynamic B_{MEY}: Australia's orange roughy



Transition to B_{MEY} (1)

- Dynamic B_{MEY} calculations provide both a target biomass and optimal harvesting path from current biomass.
- Transition to B_{MEY} may take only a few years in fast growing species (prawns) to decades for very slow-growing species (orange roughy).

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Transition to B_{MEY} (2)

- Transition costs (lower initial harvests) to B_{MEY}, in part, help explain fisher opposition to stock rebuilding.
- Inter-temporal transfers from higher, future profits can compensate for costs associated with lower current harvests.
- Appropriate individual incentives also help by providing security to current fishers they will benefit from stock rebuilding

Concluding Remarks

- Economics of overexploitation revisited indicates a ‘win-win’ — for many fisheries larger fish stocks generate higher fisher profits.
- The fishing industry debate is no longer whether it is economically advantageous to reduce current harvests — it is — but how fast should stocks rebuild.
- Dynamic B_{MEY} coupled with appropriate instruments/incentives will help overcome overexploitation in many of the world’s fisheries.